molecular processes concerned in the formation of a raindrop to attempt anything like a complete theory.

In conclusion, while we cannot but recognize the high interest of General Dyrenfurth's results, with the imperfect information at present before us we cannot regard them as conclusive. It is the characteristic weakness of all experiments of the kind that many of the essential circumstances are scarcely ever recorded, or perhaps even capable of being brought within the limits of observation: and thus the logical conditions of a proved conclusion cannot be fulfilled. For instance, it is very unlikely that anything is known of the state of the atmosphere in respect of its humidity and its vertical temperature decrement at the elevation at which the balloons were exploded, and yet, as we have seen, these data lie at the very root of the whole matter. However, arrangements are being made for further operations at El Paso and in Western Kansas, so that it will not be long before the highly interesting and practically important problem of stimulating the precipitation of rain will receive a more satisfactory solution.

H. F. B.

NOTES.

THE Permanent Committee of the International Committee of Weights and Measures is now holding its meeting at Sèvres, near Paris. The Committee includes: Dr. Foerster (Germany); M. J. Bertrand (France); Dr. Benoît, Director of the Bureau at Sèvres; Mr. H. J. Chaney (Great Britain); Prof. Govi (Italy); Prof. Krusper (Hungary); Prof. Lang (Austria); Mr. H. de Macedo (Portugal); M. Stas (Belgium); Prof. Thalen (Sweden); Dr. Wild (Russia). The Committee has recently lost its President (General Ibañez); and one of the objects of the present meeting is to elect a new President; an election which will doubtless fall on the senior member of the Committee, Dr. Foerster.

THE members of the Heilprin Expedition, who have lately returned from the west coast of Greenland, give an extremely unfavourable account of the position in which they were obliged to leave Lieutenant Peary. His leg was broken in Melville Bay on July 11. Dr. Hughes, who has recorded in the Philadelphia *Press* the adventures of the Expedition, describes how the accident happened. "While we were going astern for the last time," he says, "to make the butt that forced us through a barrier of ice into comparatively clear water, Lieutenant Peary stepped behind the wheel-house to see how things were going. With a crash the rudder struck a piece of ice, and the next instant his leg was crushed between the rudder gearing and the side of the wheel-house. He was carried below into the cabin, when an examination showed that his right leg was broken square across just above the knee. Everything possible was done for him." When he had recovered from the shock, and had thought the matter over, he decided to go on to Whale Sound, trusting that by next spring his leg would be so far mended that he would be able to accomplish the object of his expedition. His friends thought it would be better for him to return, but they could not help admiring his spirit, and resolved to do everything in their power to further his aim. The shores of Whale Sound proved to be completely blocked with ice, so the *Kite* steamed north to McCormick Bay, on the northern shore of Murchison Sound, which they reached on July 25. Here a space of about two miles was comparatively clear; and Lieutenant Peary's men went ashore, and reported that the place was well suited for their head-quarters. A site was selected on the south shore of McCormick Bay, in latitude 77° 43′, and a wooden house erected, which Lieutenant Peary declared to be "substantial and warm enough." On July 30 the Heilprin party had to leave him, which they did with sad forebodings. Mrs. Peary bravely insisted on remaining with her husband, and they have six companions. The Lieutenant hopes to start in the spring for the unexplored interior of Greenland, but Dr. Hughes says: "It is the deliberate opinion of all our party—and this opinion is indorsed fully by all the officers of the *Kite*—that unless a relief expedition be sent to Lieutenant Peary next summer, he and his party will never be seen again alive." It is doubtful whether the food supply is sufficient; and it is thought most improbable that whalers will take them away next summer. In that case their only resource would be the whale boats, in which they would have to traverse 500 miles of ocean "filled with floes and bergs, and often shrouded with fog or swept by terrible storms."

AN earthquake of great violence caused immense damage in the Republic of San Salvador on September 9. According to reports sent from the capital of the country to the *New York Herald*, there had been indications for several days that a seismic disturbance of more than usual power might be expected. The volcanoes of San Salvador, San Miguel, and Izalco had been unusually active, and deep subterranean rumblings with slight earth tremors had been felt. At 1.55 a.m., on September 9, the earthquake began in the city of San Salvador with a slight tremor, which gradually augmented. The duration of the first shock was ten seconds, during which time a frightful subterranean noise was audible in every part of the city. While the shock lasted, the earth rose and fell in long waves, and even strong men were unable to keep their feet. The walls of houses cracked, and then tottered and fell. In the capital alone 40 persons were killed, and 50 or 60 seriously injured. The experience of towns in the country seems to have been still worse. Of 320 houses at Comasagua only eight remain standing, and the loss of life there was great. Analquito has also been almost completely destroyed, and Cojutepeque, Santa Tecla, San Pedro, and Masahuet were so badly shaken as to be practically ruined. It is feared that the earthquake has been even more disastrous than those of 1854 and 1873.

IN the Isle of Fayal, among the Azores, several shocks of earthquake were felt on August 27 and 28.

MR. TUCKWELL writes to us from Loughrigg, Ambleside, that an aurora was seen there on Friday night, September 11. The arch spanned the heavens from south-west to north-east, passing nearly through the zenith. It was white, with slight coruscations at its south-west base. It was first seen at 9 p.m.: it had faded by 10 o'clock.

A NEW department of physics and electrical engineering will be begun this session at the new branch of the Manchester Technical School in Whitworth Street, where a large well-lighted warehouse is being fitted up for the purpose. The building will be lighted by electricity, the installation being fitted up with especial regard to instruction. For the latter purpose, the electric light installation in the Central School in Princess Street will also be available.

THE Library Association is holding its annual meeting this week at Nottingham. Mr. Robert Harrison, of the London Library, presides. The meeting began yesterday in the large theatre of the Nottingham University College.

THE Industrial Society of Mulhouse has issued a programme of prizes which it proposes to give for work done in the year 1891–92. A copy will be sent to anyone who applies for it to the Secretary of the Society. The prizes are very numerous, and are to be granted for work of many different kinds in connection with the application of scientific methods to industry.

A Conference on Conifers will be held at Chiswick, in connection with the Royal Horticultural Society, in October. It is hoped that this Conference will not only draw attention to the best of these trees and shrubs from a garden or landscape point of view, but show what are the best varieties to plant for English-grown timber, as well as the different uses and suitabilities of the various foreign-grown timbers. The co-operation of landowners and others who may have planted these trees or shrubs in years past, or who take a present interest in them, is specially invited.

Dredgers working in the Tiber to prepare for the construction of a new embankment brought up on September 12 a magnificent ancient Roman bronze helmet. It is perfectly preserved, and is decorated with bas-reliefs. Signor Rossi, the Italian archæologist, assigns it to the second century before the Christian era.

According to the Calcutta correspondent of the *Times*, it is understood that the Ameer of Cabul is taking steps to obtain from England a geologist, a chemist, two miners, and a number of mechanics.

The Royal Meteorological Institute of the Netherlands has just issued another useful work in maritime meteorology, viz. "Routes for Steamships between Aden and the Straits of Sunda." A previous edition appeared in 1881, but since that time steam navigation to the Dutch Indies has greatly increased, and consequently the number of logs received has afforded sufficient materials to allow of a fuller discussion of the outward and homeward routes for each month. Although there is a certain amount of regularity both as regards the monsoons and currents, yet there are considerable differences both in force and direction in the same months of different years, which cannot be taken into account in laying down general routes; but tracks laid down with great care from the most complete data available will give the best chance of successful passages. We cannot enter here into the details of the results, but we may mention that the tables and charts contained in the work show for each 10° of longitude the number of vessels which have cut those meridians in different latitudes, and the means of the number of hours taken. The tracks show that a very considerable divergence from the most direct routes is recommended in certain months, according as the east or west monsoon may be blowing. The usefulness of the work is attested by the fact that copies have been ordered for their vessels by the French, Russian, and Italian Governments.

It is expected that in no other department of the "World's Columbian Exposition" will there be a greater diversity of exhibits than in that of mines and mining. Not only will there be a magnificent array of diamonds, opals, emeralds, and other gems, and of the precious metals, but a most extensive collection of iron, copper, lead, and other ores, and of their products; of coal, granite, marble, sandstone, and other building stone; of soils, salt, and petroleum. A sub-department will take special charge of the coal and iron exhibit, and later of that of copper and lead.

Mr. O. Chanute, a well-known engineer of Chicago, has been studying the methods of preparing wood chemically to resist decay, and has expressed the opinion that great economies might be realized in America by the general adoption of these methods on railways. *Science* says he recently examined some experimental railroad ties of the most perishable kinds of wood prepared by what is known as the zinc-tannin (Wellhouse) process, in St. Louis, in 1881 and 1882, and laid in the tracks of the Atchison, Topeka, and Santa Fe Railroad, at Topeka, Kan., and La Junta, Col. After nine or ten years' exposure they show excellent results, whereas they would have lasted but from one to four years if unprepared. Unprepared ties of the same kind of timber, laid at the same time, adjoining to the prepared ties, have all decayed and been taken up, while present appearances indicate that the prepared ties (red oak, black oak, and Colorado pine) are likely to show an average life of ten to fifteen years or more. Mr. Chanute calls attention to the fact that the zinc-tannin process not only preserves ties against decay, but hardens them as well. It is found on one railroad that after three years' exposure treated hemlock ties hold the spike as well, and cut less under the rail than untreated white oak.

Some time ago the Field Naturalists' Club of Victoria organized an excursion to the Kent group of islands, the object being to collect specimens, and to determine whether the group is most nearly related with Victoria, to which it is closest geographically, or with Tasmania. At the annual *conversazione* of the Club, held recently, Mr. C. A. Topp, the retiring President, referred to the results of the expedition. The bulk of the fauna and flora was found to be common to Victoria and Tasmania, but there were six or seven varieties of birds peculiar to Tasmania to two peculiar to Victoria. The conclusion was that the islands had been separated from Tasmania after that island was disjoined from the mainland. Among the plants, several forms were found varying somewhat from the typical forms of the same species on the mainland; while it was interesting to find that the arboreal short-eared opossum had changed his habits so far as not to feed on the leaves of the eucalypt, and to keep to the ground.

In a paper in the American *Engineering Magazine*, on ventilation, Mr. Laurence Allen contends that in very many schools the quantity of pure air admitted is not sufficient to expel the foul air. To maintain the air in a good sanitary condition in a properly constructed schoolroom, his experience confirms the amount required as stated by Billings, to wit, 60 cubic feet of air for each occupant per minute. For 100 pupils this amounts to 360,000 cubic feet per hour. How many schools come up to this requirement? In the United States, says Mr. Allen, there are many schools that contain 100 pupils and do not introduce more than 25,000 feet of pure air per hour, and even that is rendered in a measure ineffective, because the air is not properly admitted. "The pupils do not die in the poisoned atmosphere; many of them will appear reasonably healthy. So do many persons who visit and tarry in malarial districts. But though the effects are not immediate and striking, they are sure, permanent, and easy to be traced to their causes in after years, by those who make a study of disease and its causes. It is scarcely less humane to kill a child than, by wilfully ignoring sanitary requirements, to cripple it for life, physically, mentally, and morally, as children are being crippled to-day in the vile atmosphere of many schools."

In a paper published in the current number of the Journal of the Anthropological Society, Mr. J. J. Lister refers to the great development of the arms and chests of the natives of Fakaofu (Bowditch Island, Union Group). He thinks it may be due to the fact that they are obliged to go about so much in canoes. Sir Joseph Lister, who took part in the discussion which followed the reading of this paper, remarked that he would not have expected the frequently repeated action of paddling to produce lengthening of the arms, although he could understand its resulting in increased size of chest. He pointed out that the natives of Tonga were also accustomed to use canoes, and hence it was not clear that the phenomenon could be traced to the cause assigned. Mr. Lister replied that, although the Tongans use canoes, canoe work is not so essential a part of their lives as it is in the case of the natives of Fakaofu. The natives of the island of Tongatabu have many avocations quite apart from the sea, for they live on an island twenty-two miles long, and many villages are situated some distance from the water. The natives of Fakaofu, on the other hand, live crowded together on a small islet situated on a ring of reefs, and to meet almost every need of their lives they must do more or less paddling.

MR. IVAN PETROFF, the United States special census agent, has been engaged in taking the census of the natives of Nunivak Island, in Behring Sea, in 60° N. lat. He found the population to consist of over 600 natives. It was previously supposed that over 300 people occupied the island. There are no white men there, and the natives live in a most primitive style. Their only food is the flesh of the walrus, and their only wealth consists of ivory obtained from the tusks of that animal. There are few land otter, but, apart from these, the natives catch no fur-bearing animals.

DR. L. WEBSTER FOX is of opinion that savage races possess the perception of colour to a greater degree than do civilized races. In a lecture lately delivered before the Franklin Institute, Philadelphia, he stated that he had just concluded an examination of 250 Indian children, of whom 100 were boys. Had he selected 100 white boys from various parts of the United States, he would have found at least five of them colour-blind: among the Indian boys he did not discover a single case of colour-blindness. Some years ago he examined 250 Indian boys, and found two colour-blind, a very low percentage when compared with the whites. Among the Indian girls he did not find any. Considering that only two females in every 1000 among whites are colour-blind, he does not think it surprising that he did not find any examples among the Indian girls.

DR. J. FRANK lately reported to the Chicago Medical Society the case of a man who periodically sheds his skin. The shedding began in his first year, and has since then occurred regularly every July. He is taken with feverish tremors, increasing almost to paroxysms. He undresses, lies down, and within a few minutes the skin of the chest begins to turn red. The redness rapidly extends over the entire skin, and the feverish tremors continue uninterrupted for about twelve hours. Then he rises, dresses, and walks about in perfect health. The skin now begins to peel, and ten hours later it comes off in great patches. From the arms and legs it can be peeled off exactly like gloves or stockings. As the old skin comes away, a new epidermis, as soft and pink as a baby's, is revealed. This new skin is very sensitive; the patient has to wear softened gloves and moccasins for about a week. After the old cuticle has been entirely removed, the finger and toe nails begin to drop off—new nails literally crowding them out. Finally, the change is complete, the man has a new skin and a new outfit of nails, and is ready to return to the mines. A lady in Washington County, Nebraska, who is thirty-nine years old, has written to Dr. Frank that since 1876 she has had a like experience every second or third year.

THE Orcutt Seed and Plant Company, San Diego, California, have issued an interesting descriptive list of Californian trees and flowers. The writer thinks that there is perhaps no country in the world where the early spring flowers so change the face of the earth from a desolate waste to a beautiful garden as on the Pacific coast—hills, mesas, mountains and valleys, and the arid plains of the desert, alike quickly responding to the vivifying rain. "California," he says, "has probably already furnished to the horticulturist a greater variety of beautiful flowers and stately trees than any other State in the Union. Yet many others are awaiting the appreciation of man, or wasting their sweetness on the desert air."

A PAPER on malformations of the bill in birds, by Mr. W. P. Pycraft, has been reprinted from the Transactions of the Leicester Literary and Philosophical Society. The most common kinds of malformation are those resulting from overgrowth of the horny sheath, and those arising from injury. Mr. Pycraft discusses these first, and then considers malformation due to embryonic disturbance.

"SYMONS'S British Rainfall, 1890," which has lately been published, contains, we need scarcely say, an enormous mass of information as to the distribution of rain over the British Isles during the year to which the volume relates. Mr. Symons points out that the only important alteration in this issue is that due to the completion of the decade 1880-89, which has enabled him to use the average for that period as a basis of comparison. He also calls attention to an article on the evaporation from soil, and to the details given as to the great rain of July 17.

THE operatives' lecture delivered at the Cardiff meeting of the British Association by Prof. Silvanus P. Thompson has been published by Messrs. E. and F. N. Spon. The subject is "Electricity in Mining."

"THE Hand-book of Jamaica for 1891-92" has just been issued. This is the eleventh year of publication. Mr. S. P. Musson and Mr. T. Laurence Roxburgh have done their best to present the fullest and latest information obtainable; and everyone who has occasion to consult the book will appreciate the care and thoroughness with which their task has been fulfilled.

A NEW edition, revised and enlarged, of the "Alkali Makers' Pocket-book," by Prof. Dr. Lunge and Dr. Hurter, will be issued in a few days in Messrs. Whittaker's Specialists' Series. As the size of the page has been somewhat increased, the designation "Hand-book" has been substituted for "Pocket-book." The same publishers are about to issue "A Practical Hand-book on the Telephone," dealing specially with telephonic exchanges, by Mr. Joseph Poole.

MESSRS. RAITHBY, LAWRENCE, AND CO. have issued a second edition, revised and enlarged, of "Simple Recipes for Sick-room Cookery," by Mrs. Buck. The writer produces an excellent impression at once by the sensible tone of the preface, in which she gives some general counsels as to the proper way of dealing with the food of the sick.

THE new number of the Journal of the Royal Horticultural Society contains, besides extracts of proceedings, a number of interesting papers. Mr. W. Warren writes on Persian cyclamen; the Rev. W. Wilks on hardy cyclamen; Dr. M. T. Masters, F.R.S., on germination of cyclamen. Snowdrops form the subject of papers by Mr. J. Allen, Mr. D. Melville, and Mr. F. W. Burbidge. There are also papers on the cultivation of hardy bulbs and plants, by Herr Max Leichtlin; Lachenalias, by Mr. F. W. Moore; Cape bulbs, by Mr. J. O'Brien; and hybrid Rhododendrons, by Prof. Henslow.

THE volume containing the Proceedings and Transactions of the Royal Society of Canada for 1890 includes papers on the American bison, by Charles Mair; the Vinland of the Northmen, by Sir Daniel Wilson; unit measure of time, by Sandford Fleming; a peculiar form of metallic iron found in Huronian quartzite on the north shore of St. Joseph Island, Lake Huron, Ontario, by G. C. Hoffmann; sun-spots observed at McGill Observatory, by C. H. McLeod; a test of Ewing and MacGregor's method of measuring the electric resistance of electrolytes, by J. G. McGregor; the later physiographical geology of the Rocky Mountain region in Canada, by G. M. Dawson; fossil plants from the Similkameen Valley and other places in the southern interior of British Columbia, by Sir J. W. Dawson.

MESSRS. SWAN SONNENSCHEIN AND CO. will issue the following books during the autumn season:—"The Colours of Animals," by Prof. Beddard, with coloured and other plates and woodcuts; "Text-book of Embryology: Man and Mammals," by Dr. Oscar Hertwig, Professor of Comparative Anatomy in the University of Berlin, translated and edited from the third German edition (with the assistance of the author) by Dr. E. L. Mark, Professor of Anatomy in Harvard University, with 389 illustrations and 2 coloured plates; "Text-book of Embryology: Invertebrates," by Drs. Korschelt and Heider, of the University of Berlin, translated and edited by Dr. E. L. Mark, with several hundred illustrations; "Text-book of Animal Palæontology," by Dr. Thomas Roberts, designed as a supplement to Claus and Sedgwick's "Text book of Zoology," illustrated; "Text-book of Geology," adapted from the work of Dr. Emanuel Kayser, Professor in the University of Marburg, by Philip Lake, of St. John's College, Cambridge, with illustrations; "Text-book of Zoology," by Dr. C. Claus, of the University of Vienna, and Adam Sedgwick, F.R.S., Vol. II. "Mollusca to Man," third edition; "The Geographical Distribution of Disease in England and Wales," by Alfred Haviland, M.D., with several coloured maps; "Introductory Science Text-books"—Additions: Introductions to the study of "Physiography," by H. M. Hutchinson; "Zoology," by B. Lindsay; "Amphioxus," by Dr. B. Hatschek, of the University of Vienna, and James Tuckey; "Geology," by Dr. Edward Aveling; "Physiological Psychology," by Dr. Th. Ziehen, of the University of Jena, adapted by Dr. Otto Beyer, with 21 figures. "Young Collector Series"—Additions: "The Telescope," by J. W. Williams; "British Birds," by the Rev. H. C. Macpherson; "Flowering Plants," by James Britten; "Grasses," by W. Hutchinson; "Fishes," by the Rev. H. C. Macpherson; "Mammalia," by the Rev. H. C. Macpherson.

AN instrument for optical comparison of transparent liquids, named a *liquoscope*, has been recently devised by M. Sondén, of Stockholm. Two hollow prisms holding the liquids are separated by a partition at right angles to the refracting angle. The whole is placed in a vessel filled with glycerine, and which allows of vision in a horizontal direction through plane glass plates. The deflection of the light rays through the prisms is thus compensated. So long as the two liquids have the same optical action, one sees a distant mark (say a black paper strip on a window) as a straight connected line; but its halves are relatively displaced if the liquids have different refractive power. The amount of displacement gives a measure of the difference, the positive or negative nature of which also appears from the direction of displacement. The author recommends his apparatus for chemical purposes, especially comparison and testing of fats and oils, analysis of glycerine, &c., and detection of margarine in butter, margarine greatly lowering the index of refraction.

HERR HUFNER has lately pointed out some of the biological bearings of the fact (observed in experiment along with Herr Albrecht) that long light-waves are much more strongly absorbed by water than short ones. If the lower marine animals had, like man, the liveliest light perception with yellow rays, and a certain intensity of light were necessary to them, they must live at a less depth than if their visual organs were most strongly affected by short-waved rays. Thus, *e.g.*, if they needed as much yellow light as that of the full moon, they could not live deeper than 177 metres (say, 590 feet). Yet they are found at all depths where food, oxygen, and a suitable temperature exist. On the other hand, the existence of plants having chlorophyll depends on light, and we might expect that the distribution of non-parasitic plants would be very limited; which is the case, no plant-organisms being found under 200 fathoms. Green plants assimilate best in yellow light; and supposing plants to assimilate in moonlight they would find their limit at the above depth (177 metres). But while yellow is here weakened to 0·0000016 of its brightness, indigo blue has still 0·007829 of its original strength, and the assimilation with blue rays will be 660 times as strong as with yellow. Different coloured marine plants react differently according to the colour of light, and they have accordingly different distribution in depth.

THE additions to the Zoological Society's Gardens during the past week include two Pinche Monkeys (*Midas œdipus* ♂ ♀) from Granada, presented by Mr. A. Aitken; a Fallow Deer (*Dama vulgaris* ♂), British, presented by Mr. J. Johnston; a Persian Gazelle (*Gazella subgutturosa* ♀) from Persia, presented by Baron Ferdinand de Rothschild; a Common Cormorant (*Phalacrocorax carbo*), British, two Yellow-browed Buntings (*Emberiza chrysophrys*), two Red-backed Buntings (*Emberiza rutila*), a —— Bunting (*Emberiza cioides*), two Japanese Greenfinches (*Fringilla kawarahibi*, var.) from Japan, purchased; a Yellow-footed Rock Kangaroo (*Petrogale xanthopus* ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE LINEAR ARRANGEMENT OF STARS.—Although the arrangement of stars in curves has often been noted and studied, little attention has been paid to what is apparently a more striking and prevalent feature, viz. straight lines and parallel arrangement of pairs, lines, and bands of stars, and of irresolvable wisps. Our knowledge of the structure of the sidereal universe is therefore extended in the required direction by some results obtained by Mr. T. W. Backhouse from observations which he has made during the last nine years in Sunderland. The area of the sky selected for scrutiny is that portion of the Milky Way included between 15, 13, 8 Monocerotis, α Orionis, ζ Tauri, and 5, μ, ξ Geminorum; and the configurations in this portion have been examined chiefly with a binocular field-glass of 2·05 inches aperture. The observations have been divided into sections, referring respectively to lines and parallel arrangements of stars, to those in clusters, to nebulous wisps, to nebulæ, and to miscellaneous lines. In these are given the detailed structure in different parts of the area showing various systems of parallel lines and wisps, together with their position-angles referred to that portion of Gould's galactic equator which runs through the middle of the area in question. The parallel arrangement of the stars, and an arrangement in straight lines, is strikingly obvious from the maps which illustrate the tabulated results of the observations. Besides the maps, sixteen figures have been drawn to show the various angles of position of the lines and streams with reference to the central line or axis of the Milky Way. From these figures it is apparent that the angles of position are grouped more numerously in certain directions than in others, the principal directions being nearly parallel to the galactic equator. Also, there is a great deficiency of position-angles at right angles to this equator. A wonderful case of radiation of stars and wisps in a fan-shaped group has been found, 68 Orionis being approximately the centre. One conclusion derived from the investigation is, that the stars and wisps in parallel lines are probably in the same region of space; and therefore that the majority of the stars in extensive tracts of the area examined are really near one another.

WOLF'S PERIODIC COMET.—This object can now be fairly seen by means of a small telescope. It will pass through the Hyades about September 25, and be 3° south of Aldebaran on October 2. The following ephemeris, from one given by Herr